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## CONTENTS

	<u>PAGE</u>
GROUND-WATER INVESTIGATIONS IN SOUTH CAROLINA, 1961. BY G. E. SIPLE.....	15-19
NEW RADIOCARBON DATES FOR THE PAMLICO FORMATION OF SOUTH CAROLINA AND THEIR STRATIGRAPHIC SIGNIFICANCE. BY JULES R. DU BAR.....	21-24

# GROUND-WATER INVESTIGATIONS IN SOUTH CAROLINA, 1961<sup>1/</sup>

By

GEORGE E. SIPLE <sup>2/</sup>

A GENERALIZED DESCRIPTION OF THE NATURE AND SCOPE OF ACTIVITIES INCLUDED IN GEOLOGIC AND HYDROLOGIC STUDIES BY THE U. S. GEOLOGICAL SURVEY, GROUND WATER BRANCH, IN SOUTH CAROLINA WAS GIVEN IN A PREVIOUS PAPER (SIPLE, 1957). THE PURPOSE OF THIS PAPER IS TO DESCRIBE THE SPECIFIC PROJECTS IN THE GROUND WATER BRANCH PROGRAM AND TO EXPLAIN BRIEFLY THEIR SCOPE AND THE NATURE OF THE DATA COLLECTED. MORE PARTICULARLY, IT DESCRIBES THE COOPERATIVE PROGRAM, WHICH IN SOUTH CAROLINA IS SUPPORTED JOINTLY BY THE SOUTH CAROLINA STATE DEVELOPMENT BOARD AND THE U. S. GEOLOGICAL SURVEY.

DURING THE CALENDAR YEAR 1961, THE COLUMBIA DISTRICT OFFICE WAS ENGAGED IN THE FOLLOWING COOPERATIVELY SPONSORED PROJECTS:

## PROJECT SC-G-1: GEOLOGY AND GROUND-WATER CONDITIONS IN THE NORTHEASTERN COASTAL PLAIN

THIS PROJECT CONSISTS OF AN AREAL RECONNAISSANCE OF THE GEOLOGY AND GROUND-WATER RESOURCES OF SEVEN COUNTIES BETWEEN THE PEE DEE RIVER AND THE NORTH CAROLINA STATE LINE. ALL BUT THE NORTHWESTERN PART OF THE AREA, CHESTERFIELD AND MARLBORO COUNTIES, IS INCLUDED IN THE COASTAL PLAIN PROVINCE. THE TWO PRINCIPAL TERRANES ARE AREAS OF MODERATE RELIEF ALONG THE SOUTHEASTERN MARGIN OF THE PIEDMONT WHICH IS UNDERLAIN BY CRYSTALLINE AND VOLCANIC ROCKS AND, TO THE SOUTHEAST, AREAS OF MODERATE TO SMALL RELIEF IN THE COASTAL PLAIN, UNDERLAIN BY UNCONSOLIDATED TO SEMICONSOLIDATED SEDIMENTS OF CONTINENTAL, DELTAIC, ESTUARINE, AND MARINE ORIGIN. THE PRINCIPAL AQUIFERS OF THE AREA ARE THOSE OF THE COASTAL PLAIN AND INCLUDE THE SANDS IN THE TUSCALOOSA, BLACK CREEK, AND PEEDEE FORMATIONS OF LATE CRETACEOUS AGE; OF LESSER IMPORTANCE ARE THE SAND AND SHELL UNITS OF MIOCENE, PLIOCENE, AND PLEISTOCENE AGE.

DATA COLLECTED INCLUDE WELL LOGS AND WELL CUTTINGS NECESSARY TO DESCRIBE THE SUBSURFACE STRATIGRAPHY, WELL INVENTORIES, AND REPRESENTATIVE WATER SAMPLES FOR CHEMICAL ANALYSIS. THE AREAL GEOLOGY WILL BE MAPPED OR COMPILED FROM EXISTING SOURCES AND PUMPING TESTS (TO DETERMINE THE AQUIFER CHARACTERISTICS OF PERMEABILITY AND STORAGE CAPACITY) WILL BE CONDUCTED. CURRENTLY, MORE DATA ARE AVAILABLE FROM FLORENCE, HORRY, AND MARLBORO COUNTIES, PROBABLY BECAUSE GROUND-WATER RESOURCES HAVE BEEN UTILIZED MORE FULLY HERE THAN IN THE REMAINING COUNTIES OF CHESTERFIELD, DILLON, DARLINGTON, AND MARION.

<sup>1/</sup> PUBLICATION APPROVED BY THE DIRECTOR, U. S. GEOLOGICAL SURVEY

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THE COASTAL PLAIN PART OF THIS AREA IS CHARACTERIZED BY SEVERAL STRUCTURAL AND STRATIGRAPHIC CONDITIONS WHICH AFFECT THE HYDROLOGY. FOR EXAMPLE, FORMATIONS THAT ARE DEEPLY BURIED IN AREAS TO THE SOUTHWEST ARE BROUGHT TO NEAR-SURFACE ELEVATIONS ALONG THE AXIS OF THE GREAT CAROLINA ARCH. THIS STRUCTURAL DEFORMATION AFFECTS THE RECHARGE-DISCHARGE AND HEAD RELATIONSHIPS OF THE ARTESIAN SYSTEMS AND MAY EVEN AFFECT THE BASE-EXCHANGE ACTIVITIES ASSOCIATED WITH THE NORMAL MOVEMENT OF GROUND-WATER FROM THE INLAND AREAS TOWARD THE COAST. ONE OF THE STRATIGRAPHIC PROBLEMS IS THE POSSIBILITY THAT THE BASAL CRETACEOUS UNIT (TUSCALOOSA FORMATION) MAY PINCH OUT DOWN-DIP IN NEAR OR OFF-SHORE AREAS (SIPLE, 1959, P. 15) OR BECOME GRADATIONAL WITH YOUNGER CRETACEOUS (EUTAW OR TAYLOR) SEDIMENTS. THE POSITION OF THESE FORMATIONAL CHANGES WILL DETERMINE IN PART THE EXTENT OF THIS AQUIFER WHICH ELSEWHERE IN THE COASTAL PLAIN HAS BEEN THE MOST PRODUCTIVE OF ANY CLASTIC AQUIFERS IN THE REGION. THE PROBLEM OF EXTENDING CORRELATION OF THE BASAL UNITS TO THE COASTAL AREAS IS DUE IN PART TO THE ECONOMIES OF THE SITUATION. MOST OF THE DATA ARE OBTAINED FROM WATER WELLS WHICH ARE TOO EXPENSIVE TO DRILL TO THESE DEPTHS IN AREAS WHERE GROUND WATER IS AVAILABLE FROM MORE SHALLOW FORMATIONS. BECAUSE OF THIS, NOT MUCH IS KNOWN CONCERNING THE PERMEABILITY OF THE SANDS IN THE TUSCALOOSA FORMATION IN THIS AREA. HOWEVER, BASED ON DATA FROM THE MIDDLE AND LOWER PARTS OF THE COASTAL PLAIN, THE PERMEABILITY OF THIS FORMATION DECREASES DOWN-DIP FROM A MAXIMUM LOCATED 25 TO 45 MILES DOWN-DIP FROM THE FALL LINE.

ALTHOUGH GRAVEL-PACKED WELLS DEVELOPED IN THE SANDS OF THE TUSCALOOSA AND BLACK CREEK FORMATIONS IN THE VICINITY OF THE CITY OF FLORENCE IN 1961 ARE REPORTED TO HAVE HIGHER YIELDS THAN EARLIER WELLS, EXTENSIVE PUMPING TESTS, BOTH IN THIS AREA AND SEVERAL MILES TO THE EAST (ALONG THE PEE DEE RIVER), CONFIRMED THE COMPARATIVELY LOW TO MODERATE TRANSMISSIBILITY OF THIS AQUIFER DETERMINED IN PREVIOUS TESTS.

TEST WELLS DRILLED IN THE CRESCENT BEACH AREA INDICATED A FAIRLY PERMEABLE SHELL BED OF LATE TERTIARY TO QUATERNARY AGE WHICH CONTAINS GROUND WATER OF LOW DISSOLVED SOLIDS AND LOW SODIUM CONTENT. THIS AQUIFER WILL PROVIDE WATER SUITABLE FOR IRRIGATION PURPOSES IN AN AREA WHERE WATER FROM THE PREVIOUSLY TAPPED AQUIFERS OF CRETACEOUS AGE YIELD A HIGH SODIUM WATER THAT IS DELETERIOUS TO SHRUBS AND LAWNS. WATER FROM THE UPPER CRETACEOUS FORMATIONS IN THE COASTAL AREA ALSO CONTAINS EXCESSIVE AMOUNTS OF FLUORIDE. BRACKISH TO SALTY WATER OCCURS IN THE DEEPER ARTESIAN AQUIFER OF LATE CRETACEOUS AGE, GENERALLY DEEPER THAN 900 FEET IN THE COASTAL AREA.

#### PROJECT SC-G-2: ALLUVIAL AQUIFERS OF THE S. C. PIEDMONT

THIS PROJECT INVESTIGATES THE AQUIFER POTENTIAL OF FLOOD-PLAIN DEPOSITS ALONG THE PRIMARY AND SECONDARY STREAMS OF THE

PIEDMONT PROVINCE AND THE FALL ZONE. ITS PRINCIPAL OBJECTIVE IS TO PROVIDE DATA FOR INDUSTRIAL, MUNICIPAL, AND OTHER USERS THAT REQUIRE WELLS HAVING COMPARATIVELY HIGH YIELDS IN AN AREA WHERE THE PERMEABILITY OF THE COUNTRY-ROCK IS LOW. TO DATE, A NUMBER OF FLOOD PLAINS HAVE BEEN TEST DRILLED WITH A POWER-AUGER TO DETERMINE THE THICKNESS AND NATURE OF THE ALLUVIUM. PUMPING TESTS HAVE BEEN MADE AT TWO SUCH SITES, AND OTHERS ARE PLANNED TO DETERMINE TRANSMISSIBILITY AND WATER-STORAGE CAPACITY. GRAIN-SIZE DISTRIBUTION AND PERMEABILITY ANALYSES HAVE BEEN MADE OF SELECTED WELL SAMPLES IN THE LABORATORY, AND ANALYSES OF ADDITIONAL SAMPLES ARE PLANNED. THE LOCATION AND TESTING OF ADDITIONAL ALLUVIAL DEPOSITS AND THE PREPARATION OF A REPORT REMAIN TO BE COMPLETED. AN EXTENSION, OR SUBSEQUENT PHASE, OF THIS PROJECT MIGHT BE THE POTENTIALS OF THE FLOOD-PLAIN DEPOSITS IN THE COASTAL PLAIN, PARTICULARLY IN THOSE PARTS WHERE PRESENT WATER SOURCES POSE PROBLEMS OF AVAILABILITY OR WATER QUALITY.

#### PROJECT SC-G-5: SUBSURFACE GEOLOGY AND HYDROLOGY OF THE S. C. COASTAL PLAIN

THE PURPOSE OF THIS PROJECT IS TO DELINEATE AND CORRELATE THE SUBSURFACE STRATIGRAPHIC UNITS OF THIS AREA WITH THEIR RECOGNIZED EQUIVALENTS IN THE ATLANTIC OR GULF COASTAL PLAIN. ITS OBJECTIVE ALSO INCLUDES THE DESCRIPTION AND DEFINITION, QUALITATIVELY AND QUANTITATIVELY, OF THE HYDRAULIC CHARACTERISTICS OF THE AQUIFERS IN THIS STRATIGRAPHIC COLUMN. THE PRINCIPAL ACTIVITIES INCLUDE THE ACQUISITION AND INTERPRETATION OF LITHOLOGIC AND GEOPHYSICAL LOGS AND THE DESCRIPTION OF WELL CUTTINGS FROM WELLS DRILLED FOR WATER SUPPLY OR TEST PURPOSES. THIS IS A CONTINUING TYPE PROJECT AND THE RESULTS OBTAINED ARE PUBLISHED PERIODICALLY AS JOURNAL ARTICLES OR PROGRESS REPORTS. ONE OF THE PUBLICATIONS PLANNED IS A STATE BULLETIN CONTAINING TABLES OF SELECTED REPRESENTATIVE WELL LOGS AND TEXT INTERPRETING THEIR DATA.

#### PROJECT SC-G-7: GROUND-WATER INVESTIGATIONS IN SOUTH CAROLINA

THIS PROJECT INCLUDES THOSE ACTIVITIES WHICH COLLECT AND INTERPRET BASIC DATA CONCERNING GROUND-WATER RESOURCES OF ALL PARTS OF THE STATE, PARTICULARLY THOSE WHICH MEET THE IMMEDIATE REQUIREMENTS FOR INFORMATION ON SPECIFIC LOCALITIES AS REQUIRED BY THE STATE COOPERATOR, OTHER FEDERAL AND STATE AGENCIES, MUNICIPALITIES, CONSULTANTS, DRILLERS, AND THE GENERAL PUBLIC. THE AREAS CONCERNED ARE USUALLY OF SMALL AREAL EXTENT ALTHOUGH ONE PHASE OF THIS PROJECT, CURRENTLY IN THE PLANNING STAGE, WOULD EXTEND OVER A COMPLETE 15-MINUTE QUADRANGLE.

PROJECT SC-G-8: WELL RECORDS, SYSTEMATIC AND  
MISCELLANEOUS OBSERVATIONS

IN THIS PROJECT, STATIC WATER LEVELS OR ARTESIAN PRESSURES IN SELECTED OBSERVATION WELLS THROUGHOUT THE STATE ARE MEASURED WEEKLY, MONTHLY, OR CONTINUOUSLY ON AUTOMATIC WATER-STAGE RECORDERS. THESE DATA ARE THEN TABULATED, USED IN THE PREPARATION OF HYDROGRAPHS (WHICH GRAPH THE CHANGE OF WATER LEVEL WITH RESPECT TO TIME) AND INTERPRETED FOR THEIR HYDROLOGIC AND GEOLOGIC SIGNIFICANCE. THIS PROJECT RUNS CONCURRENTLY WITH ONE SUPPORTED BY FEDERAL FUNDS FOR THE MAINTENANCE OF KEY FEDERAL OBSERVATION WELLS. THE DATA FROM SELECTED OBSERVATION WELLS PREVIOUSLY WERE PUBLISHED IN U. S. GEOLOGICAL SURVEY WATER-SUPPLY PAPERS ANNUALLY, BUT SINCE 1956 ARE PUBLISHED EVERY FIVE YEARS.

IN ADDITION TO THESE FIVE ACTIVE PROJECTS, THE FOLLOWING PROJECTS ARE BEING PLANNED:

(1) AREAL STUDY OF THE GROUND-WATER RESOURCES OF AREAS COMPRISING TWO OR THREE COUNTIES IN THE PIEDMONT AND COASTAL PLAIN PROVINCES. ONE OF THESE PROJECTS, WHICH WAS IN THE PLANNING STAGE IN 1961, WILL START IN 1962 WITH NEIL KOCH AS THE PROJECT CHIEF. THIS PROJECT WILL INCLUDE GREENVILLE AND SPARTANBURG COUNTIES IN THE PIEDMONT PROVINCE.

(2) A STUDY OF THE INTERRELATION OF SURFACE-WATER AND GROUND-WATER RESOURCES OF INDIVIDUAL BASINS, INCLUDING PROBABLY SOME SMALL DRAINAGE BASINS AND POSSIBLY SOME OF THE MAJOR DRAINAGE BASINS.

(3) DEFINITION OF GROUND-WATER PROBELMS INVOLVING THE CHEMICAL QUALITY OF WATER AND THEIR POSSIBLE REMEDIES. MANY OF THESE PROBLEMS ARE CONCERNED WITH THE OCCURRENCE OF EXCESSIVE CONCENTRATIONS OF IRON, HARDNESS, FLUORIDE, OR CHLORIDE IN THE GROUND-WATER SUPPLIES.

(4) DEFINITION OF THE HYDROLOGIC CHARACTERISTICS OF THE CRYSTALLINE ROCKS OF THE STATE AND THE DETERMINATION OF AQUIFER CONSTANTS IN THE WEATHERED AND FRACTURED PART OF THE ROCKS. QUANTITATIVE DATA REGARDING THE HYDROLOGY OF THESE TYPE ROCKS, BOTH IN SOUTH CAROLINA AND ELSEWHERE, ARE INADEQUATE.

THE PROJECTS DESCRIBED ABOVE ALL ARE PART OF THE FEDERAL-STATE COOPERATIVE PROGRAM. IN ADDITION, THIS OFFICE CARRIES ON SPECIFIC GEOLOGIC AND HYDROLOGIC STUDIES FINANCED ENTIRELY BY FEDERAL FUNDS AND CONDUCTED FOR THE MOST PART AT EXISTING FEDERAL INSTALLATIONS. IN THIS STATE, THESE STUDIES ARE CONDUCTED COOPERATIVELY WITH THE NAVY DEPARTMENT AT ITS FACILITIES IN BEAUFORT COUNTY, AND WITH THE ATOMIC ENERGY COMMISSION AT ITS SAVANNAH RIVER PLANT. IN ADDITION TO CONTINUING STUDIES AT THE SAVANNAH RIVER PLANT DURING 1961, THE SURVEY WAS REQUESTED BY THE ATOMIC ENERGY COMMISSION TO ASSIST MORE DIRECTLY IN A SPECIAL STUDY CONDUCTED BY THE PRIME CONTRACTOR TO DETERMINE THE FEASIBILITY OF STORING HIGH-LEVEL RADIOACTIVE WASTES IN CAVERNS EXCAVATED IN THE BURIED CRYSTALLINE ROCK.

THE DATA OBTAINED DURING 1961 ARE EITHER INCOMPLETE OR NOT YET AVAILABLE FOR PUBLICATION. HOWEVER, THE INTENSIVE AND CLOSELY SPACED TEST-HOLE DRILLING HAS CONFIRMED MANY OF THE EARLIER GEOLOGIC AND HYDROLOGIC CONCLUSIONS BASED ON LIMITED DATA OBTAINED FROM WIDELY-SPACED WATER WELLS. THIS INFORMATION CONFIRMS THE PRESENCE OF A CRYSTALLINE ROCK SAPROLITE BURIED UNDER APPROXIMATELY 900 FEET OF SEDIMENTS; THE INDICATIONS THAT THE DIP OF THE SURFACE OF THE CRYSTALLINE ROCK IS PERHAPS LOCALLY GREATER THAN THE APPARENT REGIONAL DIP; THAT THE HYDROSTATIC HEAD OF WATER IN THE CRYSTALLINE ROCKS IS HIGHER THAN THAT OF THE CRETACEOUS AQUIFER(S); AND THE PRESENCE OF WATER CONTAINING A HIGH PERCENTAGE OF TOTAL SOLIDS IN THE LOWER PARTS OF THE ROCK WELLS. THE GEOLOGY AND HYDROLOGY OF THE AREA INVOLVED IN THIS PARTICULAR STUDY WILL BE DESCRIBED IN REPORTS FOLLOWING THE COMPLETION OF THE PROJECT.

#### REFERENCES

- SIPLE, G. E., 1957, GROUND-WATER STUDIES IN SOUTH CAROLINA: MONTHLY REPORT, S. C. STATE DEVELOPMENT BOARD, OCTOBER, P. 6-10.
- \_\_\_\_\_, 1959, GUIDEBOOK FOR THE SOUTH CAROLINA COASTAL PLAIN FIELD TRIP OF THE CAROLINA GEOLOGICAL SOCIETY: SOUTH CAROLINA STATE DEVELOPMENT BOARD, DIVISION OF GEOLOGY, BULL. 24, 27 P.





NEW RADIOCARBON DATES FOR THE PAMLICO FORMATION OF  
SOUTH CAROLINA AND THEIR STRATIGRAPHIC SIGNIFICANCE

By

JULES R. DU BAR<sup>1/</sup>

INTRODUCTION

MARINE INVERTEBRATE SPECIMENS COLLECTED FROM THE PAMLICO FORMATION IN Horry County, South Carolina, were recently radiocarbon dated by E. L. Martin of Shell Research and Development Company of Houston, Texas. Each of the shells yielded dates in excess of 35,400 years B. P. The samples analyzed and the derived dates are listed below:

SAMPLE

AGE; YEARS (RADIOCARBON)

PELECYPODA

MERCENARIA CAMPECHIENSIS  
(Gmelin)

LEFT VALVE  
RIGHT VALVE

OLDER THAN 40,200  
OLDER THAN 41,200

ANTHOZOA

SEPTASTRAEA CRASSA HOLMES      OLDER THAN 35,400

THE VALVES OF MERCENARIA CAMPECHIENSIS WERE ARTICULATED AND MOST OF THE LIGAMENT PRESERVED; THE CORAL, SEPTASTRAEA CRASSA WAS ALSO WELL PRESERVED, SHOWING VIRTUALLY NO INDICATION OF ALTERATION. BOTH SPECIMENS WERE COLLECTED BY THE AUTHOR IN PLACE WHERE THE PAMLICO DEPOSITS ARE EXPOSED ALONG THE INTRACOASTAL WATERWAY, NIXONVILLE QUADRANGLE, Horry County, South Carolina, ABOUT FOUR MILES NORTHEAST OF THE ROUTE 501 BRIDGE IN MYRTLE BEACH. NEITHER OF THE SPECIMENS SHOWED ANY SIGN OF EXTENSIVE TRANSPORTION AND OCCURRED WITH OTHER MARINE FOSSILS AS PART OF A NATURAL ECOLOGIC ASSEMBLAGE.

THE PAMLICO FORMATION OF THE CAROLINAS HAS BEEN THE SUBJECT OF A RECENT AND CONTINUING PALEOECOLOGIC STUDY BY THE AUTHOR, SUPPORTED BY A GRANT FROM THE NATIONAL SCIENCE FOUNDATION.

THE BED FROM WHICH THE SPECIMENS WERE COLLECTED IS JUDGED (DU BAR AND CHAPLIN, UNPUBLISHED MANUSCRIPT; AND DU BAR, CHAPLIN AND SOLLIDAY, 1962) TO HAVE BEEN DEPOSITED JUST OUTSIDE THE SURF ZONE ON THE SHALLOW SHELF AT A WATER DEPTH OF 5 OR 6 FATHOMS. THE BOTTOM OF THE FORMATION AT THIS LOCALITY

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HAS NOT BEEN OBSERVED, BUT IS THOUGHT TO BE WITHIN 10 FEET OF THE BASE OF THE EXPOSED SECTION. THE THICKNESS OF THE OVERLYING PAMLICO DEPOSITS IS APPROXIMATELY 17.5 FEET.

THE PAMLICO FORMATION OF THE SOUTHEASTERN ATLANTIC COASTAL PLAIN GENERALLY HAS BEEN REGARDED AS A SANGAMONIAN INTERGLACIAL DEPOSIT. A FEW GEOLOGISTS, THE AUTHOR INCLUDED, HAVE CONSIDERED THE POSSIBILITY THAT THE FORMATION DATES FROM A TIME OF GLACIAL RECESSION DURING THE WISCONSINAN. THE PRESENT RADIOCARBON DATES STRONGLY SUPPORT A SANGAMONIAN AGE FOR THE PAMLICO DEPOSITS OF SOUTH CAROLINA, ASSUMING THE WISCONSIN ICE AGE STARTED ABOUT 50,000 TO 60,000 YEARS AGO (FREY, 1962).

#### EARLIER RADIOCARBON DATES

TWO PUBLISHED DATES FOR THE PAMLICO FORMATION ARE KNOWN TO THE AUTHOR (ARNOLD & LIBBY, 1951; FLINT, 1956; AND OLSON & BROECKER, 1961). SAMPLE NUMBERS AND GEOLOGIC AND GEOGRAPHIC DATA RELATED TO THESE DATES ARE LISTED BELOW:

<u>SAMPLE DESCRIPTION</u>	<u>RADIOCARBON AGE (YEARS BP)</u>
<u>SAMPLE 105</u>	
CYPRESS WOOD IN "HORRY CLAY"; MYRTLE BEACH, HORRY COUNTY, SOUTH CAROLINA INTRACOASTAL WATERWAY UNDER PAMLICO TERRACE (ARNOLD & LIBBY, 1951, P. 115).	OLDER THAN 20,000

#### SAMPLE L-222A

CEDAR FROM A PEAT BED EXPOSED AT LOW TIDE IN MYRTLE BEACH STATE PARK, SOUTH CAROLINA (OLSON & BROECKER, 1961, P. 152).	OLDER THAN 31,000
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AT LEAST ONE OF THE SAMPLES (105) WAS TAKEN FROM THE "HORRY CLAY" OF COOKE (1937). COOKE CONSIDERED THIS CLAY TO BE OLDER THAN THE PAMLICO AND TO DATE FROM A GLACIAL STAGE. FLINT AND DEEVEY (1951) CONCLUDED THAT THE PAMLICO FORMATION AND THE "HORRY CLAY" BOTH DATE FROM THE SANGAMONIAN.

FREY (1952) STUDIED THE POLLEN AND SPORE CONTENT OF THE "HORRY CLAY" NEAR MYRTLE BEACH, AND CONCLUDED THAT THE UPPER THREE FEET WHICH CONTAINS THE DIATOM SPECIES, POLYMYXUS CORNALIS WAS DEPOSITED UNDER MARINE INFLUENCE DURING A TIME WHEN THE WATER TEMPERATURE WAS SOMEWHAT HIGHER THAN OFF THE COAST OF SOUTH CAROLINA TODAY. THE LOWER PART OF THE CLAY HE CONSIDERED TO BE NONMARINE AND TO HAVE BEEN DEPOSITED DURING A RELATIVELY COOL PERIOD.

THE DATE OF MORE THAN 20,000 YEARS B. P. (SAMPLE 105) WAS DETERMINED BY THE OLD SOLID CARBON METHOD AND THUS COULD NOT BE ACCEPTED AS UNQUESTIONABLY VALID. SAMPLE L-544 CAME FROM A PEAT DEPOSIT SUPPOSEDLY OVERLYING THE MARINE PAMLICO SO THAT THE DATE OF MORE THAN 31,700 YEARS B. P. CERTAINLY WOULD SEEM TO PLACE THE PAMLICO INTO THE SANGAMON INTERGLACIAL. HOWEVER, IN THE AUTHOR'S OPINION, THE STRATIGRAPHIC POSITION OF THIS SAMPLE, AS WELL AS SAMPLE 105, HAD NOT BEEN CLEARLY ESTABLISHED.

WITH THE EXACT STRATIGRAPHIC RELATIONSHIP OF THE "HORRY CLAY" AND THE MYRTLE BEACH SEASIDE PEAT DEPOSITS IN DOUBT, THE SIGNIFICANCE OF THE EARLIER RADIOCARBON DATES COULD NOT BE ADEQUATELY EVALUATED. HOWEVER, RECENTLY DU BAR AND CHAPLIN (UNPUBLISHED MANUSCRIPT) HAVE PRESENTED EVIDENCE DEMONSTRATING THAT THE "HORRY CLAY" IS MERELY A FACIES OF THE PAMLICO FORMATION.

### STRATIGRAPHIC RELATIONSHIP OF THE PAMLICO FORMATION

THE PAMLICO FORMATION WAS NAMED BY STEPHENSON (CLARK ET. AL, 1912) FROM THE PAMLICO SOUND AREA IN NORTH CAROLINA. THE SURFACE OF THE FORMATION IS COMMONLY EXPRESSED AS A GENTLY SLOPING MARINE TERRACE COMMONLY BOUNDED ON THE LANDWARD SIDE BY A LOW SEAWARD-FACING SCARP OR A SERIES OF BEACH RIDGES AND SAND DUNES. IT IS THOUGHT THAT THE TERRACE AND THE FORMATION WERE FORMED WHEN THE PLEISTOCENE SEA ROSE EUSTATICALLY 25 TO 30 FEET HIGHER THAN AT PRESENT.

THE TERRACE AND THE UNDERLYING DEPOSITS HAVE BEEN TRACED FROM NEW JERSEY TO FLORIDA (RICHARDS, 1936). THE AUTHOR HAS CONSIDERED THE LATE PLEISTOCENE DEPOSITS OF SOUTHERN FLORIDA, INCLUDING THE FT. THOMPSON, ANASTASIA, MIAMI OOLITE AND KEY LARGO LIMESTONE, TO BE CORRELATIVES OF THE PAMLICO, BUT PLACED ALL OF THESE FORMATIONS IN THE WISCONSINAN (DU BAR, 1958). BASIS FOR THIS OPINION IS THE PRESENCE IN THE UNDERLYING CALDOOSAHATCHEE MARL OF FLORIDA OF A VERTEBRATE FAUNA OF SANGAMONIAN AFFINITIES (DU BAR, 1958).

THE INVERTEBRATE FAUNA OF THE CALDOOSAHATCHEE, IN THE OPINION OF THE AUTHOR, PRECLUDES THE POSSIBILITY OF CORRELATION WITH THE PAMLICO OF SOUTH CAROLINA, BUT DOES SHOW CLOSE AFFINITY WITH THAT OF THE WACCAMAW OF THE CAROLINAS, GENERALLY REGARDED AS PLIOCENE (DU BAR, 1959).

THERE SEEMS NO DOUBT THAT THE CALDOOSAHATCHEE IS A PLEISTOCENE FORMATION AND RECENT STUDIES BY THE AUTHOR HAVE TENDED TO CONFIRM A PLEISTOCENE AGE FOR THE WACCAMAW FORMATION. IT IS SUGGESTED THAT THE RANGE OF VERTEBRATE FOSSILS ENCLOSED IN THE CALDOOSAHATCHEE MARL MUST BE EXTENDED SO THAT THAT FORMATION AND ALSO POSSIBLY THE WACCAMAW CAN BE PLACED IN THE YARMOUTHIAN INTERGLACIAL. ALTHOUGH THE FT. THOMPSON, ANASTASIA, KEY LARGO AND MIAMI OOLITE FORMATIONS MIGHT EVENTUALLY PROVE TO BE WISCONSINAN, IT SEEMS MOST LOGICAL TO CONTINUE

THEIR CORRELATION WITH THE PAMLICO OF SOUTH CAROLINA AND  
THUS REGARD THEM AS SANGAMONIAN IN AGE.

#### BIBLIOGRAPHY

- ARNOLD, J. R. & LIBBY, W. F., 1951, RADIOCARBON DATES:  
SCIENCE, VOL. 113, P. 111-120.
- CLARK, W. B. ET. AL., 1912, THE COASTAL PLAIN OF NORTH  
CAROLINA: NORTH CAROLINA GEOL. & ECON. SURVEY, VOL.  
3, P. 1-540.
- COOKE, C. WYTHE, 1937, THE PLEISTOCENE HORRY CLAY AND PAM-  
LICO FORMATION NEAR MYRTLE BEACH, S. C.: JOUR. WASH.  
ACAD. SCI., VOL. 27, PP. 1-5.
- DU BAR, JULES R., 1958, STRATIGRAPHY AND PALEONTOLOGY OF  
THE LATE NEOGENE STRATA OF THE CALOOSAHOATCHEE RIVER  
AREA OF SOUTHERN FLORIDA: FLORIDA GEOL. SURVEY BULL.  
40, P. 1-267.
- \_\_\_\_\_, 1959, THE WACCAMAW AND CROATAN DEPOSITS OF THE  
CAROLINAS: GEOLOGIC NOTES, VOL. 3, NO. 6, P. 1-9.
- \_\_\_\_\_, CHAPLIN, J. R. & SOLLIDAY, J. R., 1962,  
PALEOECOLOGY OF THE PAMLICO DEPOSITS (LATE PLEISTOCENE)  
OF HORRY COUNTY, SOUTH CAROLINA: (ABSTRACT); PROGRAM  
ANN. MTG. AMER. ASSOC. PETROL. GEOLOGISTS, VOL. 46,  
NO. 2, P. 264.
- FLINT, R. F., 1956, NEW RADIOCARBON DATES AND LATE PLEISTO-  
CENE STRATIGRAPHY: AMER. JOURNAL SCIENCE, VOL. 254,  
NO. 5, P. 265-287.
- \_\_\_\_\_, & DEEVEY, E. S., 1951, RADIOCARBON DATING OF LATE  
PLEISTOCENE EVENTS: AMER. JOURNAL SCIENCE, VOL. 249,  
P. 257-300.
- FREY, DAVID G., 1952, POLLEN ANALYSIS OF THE HORRY CLAY AND  
SEASIDE PEAT DEPOSIT NEAR MYRTLE BEACH, SOUTH CAROLINA:  
AMER. JOURNAL SCIENCE, VOL. 250, P. 212-225.
- FRYE, JOHN C., 1962, COMPARISON BETWEEN PLEISTOCENE DEEP-  
SEA TEMPERATURES AND GLACIAL AND INTERGLACIAL STAGES:  
BULL. GEOL. SOCIETY AMERICA, VOL. 73, NO. 2, P. 263-  
266.
- OLSON, E. A. & BROECKER, W. S., 1961, LAMONT NATURAL RADIO-  
CARBON MEASUREMENTS VII: RADIOCARBON, VOL. 3, P. 141-  
175.
- RICHARDS, HORACE G., 1936, FAUNA OF THE PLEISTOCENE PAMLICO  
FORMATION OF THE SOUTHERN ATLANTIC COASTAL PLAIN: BULL.  
GEOL. SOCIETY AMERICA, VOL. 47, P. 1611-1656.
- \_\_\_\_\_, 1959, RECENT STUDIES OF THE PLEISTOCENE OF THE  
SOUTH ATLANTIC COASTAL PLAIN: SOUTHEASTERN GEOLOGY,  
VOL. 1, NO. 1, P. 11-21.

